10\RR-75

10/532145
JC13 Rec'd PCT/PTO 20 APR 2005

[001]ROLLER TRACK DEVICE FOR MOVING A LOAD IN A SUBSTANTIALLY HORIZONTAL PLANE

[002]
[003]
[004] The present invention concerns a roller track device for moving a load in a substantially horizontal plane between a load handling apparatus and a machine, said device being used to equip the forks on said handling apparatus and comprising at least one rail defining at least one plane contact surface capable of supporting said load when it is static, said rail being hollow, substantially horizontal, and having a longitudinal opening, at least one counter-rail housed within said rail within which roller devices are attached opposite said longitudinal opening, said roller elements being contained in a plane that is generally parallel to said surface and being capable of supporting said load when it is moving, at least one of the structures being associated with actuation means so to be movable relative to the other between at least a lower position and an upper position, in which positions the load is supported either by the rail or by the counter-rail, said actuation means displacing the structure known as the movable structure in at least horizontal translation, and lifting means located between the two structures so as to generate vertical displacement of the structure known as the movable structure simultaneous with its horizontal displacement. The present invention also concerns a handling device with forks that is equipped with such a roller device.

[005]

[006] In industry, load handling platforms such as, for example, elevator cars and stacking equipment are currently used to handle heavy loads. These heavy loads might consist of tools for machine tools, presses used to cut or stamp metal, or molds or forms used in the injection of synthetic material, etc. Generally, loads of less than two tons are transported on load handling platforms, while loads from two to ten tons are transported using fork apparatuses. Loads of over ten tons are transported by cranes.

[007] To facilitate the transfer of loads in the horizontal plane from the handling platform to the machine tool or vice versa, handling equipment now in use is provided with a roller device integral with the forks, designed to support the load and displace it without friction on the free roller devices. This handling equipment may also be provided with articulated arms designed to push or pull the load. The roller device generally comprises a "roller support structure" surmounted by a "load support structure." The function of the load support structure is to support the load while the handling apparatus moves, whereas the function of the roller support structure is to support it without friction in order to effect the transfer. Passing the load from one structure to the other and vice versa is accomplished through the displacement of one structure relative to the other so that the roller devices on the roller-support structure can be retracted or extended

relative to the load support structure, said relative displacement being controlled by means of manual or automatic actuators.

[008] In load handling devices using forks, this relative movement is generally controlled automatically either by a block provided on the machine tool and cooperating with said movable structure when the forks are attached, or by a cylinder integrated within the handling apparatus.

[009] In Publication DE-A-36 20 964 displacement of the structure called the movable structure is generated by a stop when the forks are attached to the machine tool, which causes the roller support structure to rise by making it pivot on an axle located in the tablet of the load handling apparatus. This is not a satisfactory solution because it requires a broad amplitude of movement, which increases the time required to transfer the load and necessitates use of large fork due to this amplitude. Moreover, the load is not uniformly distributed and there is no guaranty of simultaneous movement between the roller support structures, leading to premature wear and deterioration of the roller device. In addition, this system cannot be adapted to equip load handling apparatuses already in use.

[010] In Publications US-A-3 243 029, US-A-4 930 612 and US-A-5 915 515, displacement of the structure called the movable structure is accomplished by a cylinder that raises the roller support structure through the intermediary of inclined ramp systems or bearings. These solutions are unsatisfactory as well,

since they require a specific external energy source for supplying the cylinder or cylinders. These approaches are complex, expensive, and require a lot of space. Moreover, their design does not facilitate cleaning and maintenance of the roller devices, since the roller support device is difficult to disassemble. Finally, they are not suitable for retrofitting load handling apparatuses already in use.

[011]

[012] The present invention proposes overcoming these disadvantages with a roller device based on simple kinematics without any outside energy source which limits the number of pieces, reduces both the cost and space requirements for the unit, facilitates maintenance and cleaning, and which is suitable for both new apparatus and retrofitting existing ones.

[013] To achieve this, the invention concerns a roller device of the type indicated in the preamble characterized in that the actuation means comprises at least one block designed to be installed on said machine and at least one actuator located between the two structures which cooperates with said block so as to transform a vertical force exerted by said block on said actuator into a horizontal force exerted by said actuator onto said structure called the movable structure, displacing it in horizontal translation when the forks of the load handling devices are attached to said machine.

[014] In a preferred embodiment the lifting means comprises inclined ramps integral with said rail which cooperate with said roller elements on said counter-rail. These inclined ramps define at least a first zone which allows at least the tops of the roller elements to project, a second zone designed to cover the roller elements, and an intermediate zone designed to form, in combination with the roller elements, the lifting ramps. Each roller element advantageously comprises at least one roller designed to support the load in position for motion, said roller being attached to a generally horizontal axle between two rollers of smaller diameter, with the rollers being in contact with the inclined ramps.

[015] In a variation the lifting means may comprise articulated bearings having one extremity connected to said rail and other extremity connected to said counter-rail.

[016] Said actuator may be chosen from the group comprising at least a pivoting lever, a ball and socket, a rotating device, or a cylinder.

[017] Preferably the rail is fixed and the counter-rail supporting the roller elements is movable and cooperates with said actuator, the purpose of said actuator being to displace the counter-rail from its lower position to its upper position when it is in contact with the block and to allow the counter-rail to descend by gravity when it is no longer in contact with the block.

[018] In a first variation, the actuator comprises at least one pivoting lever attached to the rail by an axle oriented in a generally perpendicular to the direction of horizontal displacement of the counter-rail, said pivoting lever comprising at least two contact zones located on either side of the axle, one of which is in contact with the counter-rail and the other of which cooperates with said block. This pivoting lever comprises at least one roller located between the two contact zones and designed to supplement the roller elements on the counter-rail when it is in the upper position.

[019] In a second variation the actuator comprises at least one pivoting lever attached to said counter-rail by an axle oriented generally perpendicular to the direction of horizontal displacement of the counter-rail, said pivoting lever comprising at least two contact zones, one of which is in contact with the rail and the other of which cooperates with said block. One of the contact zones preferably constitutes a ramp capable of cooperating with a rotating element integral with said rail.

[020] In a third variation, the actuator comprises at least one rotating element attached to said counter-rail by an axle oriented generally perpendicular to the direction of horizontal displacement of the counter-rail, said rotating element being designed to move along an inclined ramp integral with said block, said rail being guided in vertical translation within said block by a tenon-slide system.

[021] In a fourth variation the actuator comprises at least one ball and socket consisting of at least one contact zone located at the intersection of two articulated lever arms and respectively connected to said rail and said counter-rail along two axles generally perpendicular to the direction of horizontal displacement of said counter-rail, with the contact zone being designed to cooperate with said block. The contact zones advantageously consist of rotating elements.

[022] In a fifth embodiment the actuator comprises at least one double cylinder, a first piston of which cooperates with said counter-rail and is oriented generally perpendicular to the direction of its horizontal displacement, with the second piston cooperating with said block and oriented generally perpendicular to said first piston. The second piston is preferably associated with a recall device. The piston chambers may be separate and connected by at least one conduit housed within the rail.

[023] In a sixth embodiment the actuator comprises at least one rotating element attached to the rail by an axle oriented generally perpendicular to the direction of horizontal displacement of the counter-rail and guided translationally within the rail by grooves, said rotating element cooperating with two ramps that are provided on the rail and the counter-rail, respectively, at least one of the ramps being inclined. This rotating element comprises at least three coaxial rollers of different diameters, at least two of which are movable in relation to each other,

said rollers cooperating respectively with the ramp integral with the rail, the ramp integral with the counter-rail, and the block.

[024] The block is preferably selected from among at least a tie rod which can receive the front extremity of said forks and a machine table, said block being at least partially shaped to be compatible with the actuator.

[025] For the same purpose, the invention concerns a load handling apparatus with forks of the type indicated in the preamble characterized in that it comprises at least one roller device as defined above.

[026]

[027] The advantages of the present invention will be more apparent from the following description of several embodiments cited by way of non-limiting examples, with reference to the attached drawings, wherein:

[028] Figure 1 is a perspective of a roller device according to the invention in the shape of a fork;

[029] Figure 2 is a partial perspective of the device of Figure 1;

[030] Figure 3 is a functional schema of the device of Figure 1;

[031] Figures 4A and 4B are partial side views of the device of Figure 1, shown respectively in the extended and retracted positions;

[032] Figure 5 is a functional schema of a first variation of the device of the invention;

[033] Figures 6A and 6B and partial side views of the device corresponding to Figure 5 shown respectively in the retracted and extended positions;

[034] Figures 7A, 7B and 7C are schematic views of a second variation of the device according to the invention, respectively showing a side view in the retracted position, a top view and a side view in the extended position;

[035] Figures 8A and 8B are schematic views of a third variation of the device of the invention shown respectively in retracted and extended positions;

[036] Figures 9A and 9B are views similar to Figures 8A and 8B with other lifting means;

[037] Figures 10A, 10B and 11A, 11B are schematic views of a fourth and fifth variation of the device of the invention shown respectively in the retracted positions and extended; and

[038] Figures 12A, 12B, 13A and 13B are schematic views of a sixth and seventh variation of the invention shown respectively in the retracted and extended positions.

[039]

[040] With reference to Figures 1 through 4 roller device 100 according to the invention is fork-shaped and designed to equip a conventional load handling device with two parallel forks (not shown). It performs two functions: static support with friction of very heavy loads 1 weighing up to about 10 tons while the load handling apparatus is moving, and dynamic support of these loads 1 without friction while they are being transferred in a plane A parallel to the forks to or from a machine 20 which may be a machine tool, a press, an injection machine, or any other fixed or movable plane surface.

[041] This roller device 100 comprises a roller support structure 200 comprising roller elements 230 surmounted by a load support structure 300 having a plane contact surface S provided with an opening 320 which allows at least the tops of the roller devices 230 to be visible. In this embodiment, and as shown schematically by Figure 3, roller support structure 200 is movable, in relation to load support structure 300 which is fixed, between two positions, at least one of which is stable: a lower position in which it retracts roller devices 230, with load 1 being in plane contact on surface S of load support structure 300, and an upper position in which it releases the tops of roller devices 230, with load 1 being either in linear contact or contact at some points on roller elements 230. Obviously the reverse configuration is also possible, that is, having the load support structure 300 movable relative to roller support structure 200.

[042] Roller support structure 200 is associated with actuation means 400 which displace it in horizontal translation Th along a course Ch and with lifting means 500 which displace it in vertical translation Tv on a course Cv simultaneously with horizontal displacement Th, with course Cv being shorter than course Ch. The originality of roller device 100 of the invention resides in the fact that the actuating means 400 is mechanical and automatic, integrated within roller device 100, occupies only a small space, and does not require any energy input. The other originality resides in the lifting means 500 which, rather than consisting of supplemental expensive and complicated mechanisms, is directly integrated within load support structure 300 and roller support structure 200. It is the specific result of moving contact between pieces 330, 240 respectively provided on load support structure 300 and roller support structure 200, said pieces 330, 240 being specifically shaped to form a lifting ramp as explained below.

[043] In the example shown, load support structure 300 consists of a hollow, U-shaped rail 310 for use in the horizontal position defining a longitudinal opening 320 in the upper portion and an interior housing receiving roller support structure 200. Said rail 310 comprises at its rear extremity a vertical support 340 forming a fork 10, said support being equipped with jaws 341 allowing said fork 10 to be attached to the same place and in the same position as the existing forks on a standard load handling device. At its front extremity, said rail 310 comprises a

lower notch 350 capable of engaging with a tie rod on a machine 20, for example. Inside rail 310 blocks 330 with inclined ramps 331 are attached, each block 330 comprising two parallel inclined ramps 331. These inclined ramps 331 define at least one first zone 331a which allows at least the tops of roller elements 230 to project, a second zone 331b for covering roller elements 230, and an intermediate zone 331c which forms, in combination with roller elements 230, the lifting means 500.

[044] The roller support structure 200 constitutes a counter-rail 210 open from side to side and with dimensions that are complementary to those of the interior housing in rail 310 so as to be freely movable within said rail 310 in horizontal translation Th and in vertical translation Tv. Said counter rail 210 is guided within rail 310 by their respective lateral sides. It comprises a plurality of rollers 230 aligned along its median axle in a plane parallel to plane contact surface S of rail 310, said rollers 230 being essentially cylindrical and constituting the roller elements. Each roller 230 is freely attached to a transverse axle 220 integral with counter-rail 210. Each transverse axle 220 also supports two rollers 240 located on either side of roller 230, having a smaller diameter than roller 230 and positioned opposite and in contact with ramps 331 on a block 330.

[045] Roller support structure 200 is associated with an actuation means 400 which, in the example shown, is mechanical and automatic, and comprises a block

consisting of the tie rod 450 attached to machine 20 and an actuator in the form of a pivoting lever 410 integral with roller device 100 and cooperating with said block. The tie rod may be attached to machine 20 with clamps 451 or any other appropriate means. Pivoting lever 410 is generally triangular with three tips and located in front of counter-rail 210 in the area of the front extremity of rail 310. This pivoting lever 410 is attached to an axle 420 integral with rail 310 and perpendicular to direction Th. It is designed to transform a vertical force exerted by tie rod 450 when forks 10 are attached to machine 20 into a horizontal force capable of displacing counter-rail 210 in horizontal translation. Therefore, the force transmitted by this pivoting lever 410 to counter rail 210 is generally proportionate to the size of load 1. Said pivoting lever 410 comprises three distinct contact zones forming the three tips of the triangle and constituting roller elements: a roller 430 located opposite lower notch 350 on rail 310 and disposed to contact tie rod 450, a roller 440 in moving contact with the front extremity of counter-rail 210, and a roller 230 disposed to complement roller elements 230 on roller support structure 200. Obviously the actuator may consist of any other equivalent means such as, for example, a cylinder (cf. Figures 10 and 11), a nut and bolt, a ball and socket (cf. Figures 8 and 9), a simplified lever (cf. Figures 5 and 6), a roller element associated with an inclined ramp (cf. Figure 7), etc.

[046] Figures 4A and 4B illustrate the operation of this pivoting lever 410. In Figure 4B pivoting lever 410 is at rest, which corresponds to counter-rail 20 being in the lowered position in which rollers 230 are retracted inside rail 310. This lowered position is stable. In Figure 4A pivoting lever 410 is actuated by tie rod 450 added to machine 20 while forks 10 descend as the load handling device attaches to machine 20. Tie rod 450 exerts on pivoting lever 410 through roller 430 an upward vertical force causing it to rotate in a counterclockwise direction at an angle of about 45°, moving roller 230 on lever 410 into the extension of the other rollers 230 and pushing counter-rail 210 in horizontal translation Th, said counter-rail simultaneously effecting vertical translation Tv by virtue of the displacement of rollers 240 on inclined ramps 331. Counter-rail 210 is moved to the upper position in which rollers 230 project above surface S of rail 310. This upper position is not stable since when forks 10 are disengaged from tie rod 450, counter-rail 210 descends inclined ramps 331 due to gravity and returns to the lower position, simultaneously returning pivoting lever 410 to its resting position (cf. Fig. 4B).

[047] Figures 5 and 6 illustrate a roller device 110 similar to the preceding one with only the actuation means 400' being different. Actuation means 400' comprises an upright pivoting lever 410' with two extremities cooperating with a mechanical block consisting of table 20' of machine 20. This pivoting lever 410'

is attached at one end to an axle 420' integral with counter-rail 210 and oriented in a generally perpendicular direction to the direction of horizontal displacement Th of said counter-rail 210. As before, it is designed to transform the vertical force exerted directly by table 20' of machine 20 when forks 10 are attached into a horizontal force capable of displacing counter-rail 210 in horizontal translation Th. This pivoting lever 410' comprises two contact areas 430', 440'. Contact area 430' is located at the free extremity of pivoting lever 410' and enters into contact with table 20' of machine 20 when forks 10 become attached to tie rod 450'. Contact zone 440' consists of a ramp extending between the two extremities of pivoting lever 410' in a slight curve and capable of cooperating with a rotating element 441' integral with rail 310 and attached to the extremity of support arm 442'.

[048] Figures 6A and 6B illustrate the operation of this pivoting lever 410'. In Figure 6A the pivoting lever 410' is at rest, corresponding to counter-rail 210 being in the lower position in which rollers 230 are retracted inside rail 310. This lower position is stable. In Figure 6B pivoting lever 410' is actuated by table 20' on machine 20 which transmits an upward vertical force, causing it to rotate clockwise at an angle of about 30°, with ramp 440' being displaced relative to fixed rotating element 441' and generating the displacement of counter-rail 210 in horizontal translation Th. The latter simultaneously effects vertical translation Tv

due to the displacement of rollers 240 along inclined ramps 331. Counter-rail 210 is moved to the upper position in which rollers 230 project above surface S of rail 310. This upper position is not stable because when forks 10 are disengaged from machine 20, counter-rail 210 descends inclined ramps 331 due to gravity, returning to the lower position, and returning pivoting lever 410' to its resting position (cf. Figure 6B).

[049] Figures 7A through 7C illustrate a third roller device 120 wherein the actuation means 600 comprises an actuator in the form of a moving device 610 integral with counter-rail 210 and associated with a block formed of an inclined ramp 620 provided in a tie rod 650 added to machine 20. Moving device 610 may consist, for example, of a roller attached to an axle at the front extremity of counter-rail 210 and inclined ramp 620 is situated between two lateral sides of tie rod 650. These lateral sides comprise the parallel and vertical slides 640 which receive tenons 630 provided on either side of the front extremity of rail 310 to ensure that forks 10 are mechanically attached to machine 20.

[050] Figures 7A and 7C illustrate the operation of this actuation means 600. In Figure 7A roller device 120 is at rest, corresponding to counter-rail 210 being in the lower position wherein rollers 230 are retracted inside rail 310. This lower position is stable. In Figure 7C, roller 610 moves along inclined ramp 620 while forks 10 descend to attach the load handling device to machine 20. The vertical

force exerted by tie rod 650 is transformed into horizontal force against counter-rail 210 because of the combination of inclined ramp 620 with roller 610. Counter-rail 210 effects, simultaneously with its horizontal translation Th, vertical translation Tv due to the displacement of rollers 240 along inclined ramps 331. Counter-rail 210 is moved to the upper position in which rollers 230 project above surface S of rail 310. This upper position is not stable because when forks 10 are disengaged from machine 20 toward the top, rolling element 610 again travels up inclined ramp 620, allowing counter-rail 210 to descend inclined ramps 331 due to gravity and return to the lower position (cf. Figure 7A).

[051] Figures 8A and 8B are schematic representations of a fourth roller device 130 in which the actuation means 700 comprises an actuator in the form of a ball and socket 710 integral with roller device 130 and associated with a block formed of a tie rod 750 added to machine 20. Ball and socket joint 710 comprises a rolling element 720 attached to the intersection of two articulated lever arms 730. The extremities of these lever arms 730 are respectively attached to rail 310 and to counter-rail 210 by an articulation 740. In Figure 8A ball and socket 710 is at rest, corresponding to counter-rail 210 being in the lower position in which rollers 230 are retracted inside rail 310. This lower position is stable. In Figure 8B ball and socket 710 is actuated by tie rod 750 which exerts an upward vertical force on rolling element 720 as forks 10 descend to attach the load handling device to

machine 20. This upward vertical force is transformed into horizontal force against counter-rail 210 due to lever arms 730 and articulations 740. Counter-rail 210 effects simultaneously with its horizontal translation Th, vertical translation Tv due to the displacement of rollers 240 on inclined ramps 331. Counter-rail 210 is moved to the upper position in which rollers 230 project above surface S of rail 310. This upper position is not stable because when forks 10 are disengaged from machine 20, counter-rail 210 descends include ramps 331 due to gravity to return to the lower position and simultaneously return ball and socket 710 to its resting position (cf. Figure 8A).

[052] Figures 9A and 9B are schematic representations of a fifth roller device 140 using the same actuations means 700 as the previous device. The difference resides in the lifting means 500' which comprises articulated bearings 510 disposed between rail 310 and counter-rail 210. When counter-rail 210 is displaced in horizontal translation Th by ball and socket 710 in contact with tie rod 750, it simultaneously effects vertical translation Tv due to the pivoting of bearings 510 between their fixed point, integral with rail 310, and their movable point, integral with counter-rail 210. Figures 9A and 9B show roller device 140 in retracted and extended positions, respectively.

[053] Figures 10A and 10B are schematic representations of a sixth roller device 150 in which the actuation means 800 comprises an actuator in the form of a

cylinder 810 integral with roller device 150 and associated with a block formed of a tie rod 850 added to machine 20. Cylinder 810 is a double cylinder, hydraulic or pneumatic, consisting of one chamber and two perpendicular pistons 820, 840. One piston 820 is essentially vertical and enters into contact with tie rod 850. It is associated with a recall spring 830. The other piston 840 is generally horizontal and attached to the front extremity of counter-rail 210. In Figure 10A, cylinder 810 is at rest, which corresponds to counter-rail 210 being in the lower position in which rollers 230 are retracted inside rail 310. This lower position is stable. In Figure 10B cylinder 810 is actuated by tie rod 850 which exerts an upward vertical force on piston 820, causing it to rise by compressing its recall spring 830 and causing the fluid in its chamber to push piston 840 out, said piston 840 then exerting horizontal force on counter-rail 210. Counter-rail 210 effects simultaneously with its horizontal translation Th, vertical translation Tv due to the displacement of rollers 240 along inclined ramps 331. Counter-rail 210 is moved to the upper position in which rollers 230 project above surface S of rail 310. This upper position is not stable because when forks 10 are disengaged from machine 20, piston 820 again moves down due to the action of its recall spring 230, allowing counter-rail 210 to descend inclined ramps 331 due to gravity and return to the lower position, while cylinder 810 is returned to the resting position (cf. Fig. 10A).

[054] Figures 11A and 11B are schematic representations of a seventh roller device 160 similar to the preceding one, with the actuation means 900 also comprising an actuator in the form of a cylinder 910 integral with roller device 150 and associated with a block formed of a tie rod 950 added to machine 20. In this variation cylinder 910 is a double cylinder, hydraulic or pneumatic, consisting of two pistons 920, 940, each associated with a separate chamber 911, 913, the two chambers being joined by a conduit 912. One of the pistons 920 is generally vertical in order to enter into contact with tie rod 950. It is associated with a recall spring 930. The other piston 940 is generally horizontal and attached to the rear extremity of counter-rail 210. In this variation inclined ramps 331 are reversed in relation to those of Figures 10A and 10B. The functioning of this roller device 160 is the same as the preceding one and will not be repeated.

[055] Figures 12A and 12B are schematic representations of an eighth roller device 170 in which the actuation means 1000 comprises an actuator in the form of a rotating element 1010 cooperating with an inclined ramp 1020 integral with roller device 170 and associated with a block formed of a tie rod 1050 added to machine 20. Inclined ramp 1020 is provided in the area of the front extremity of rail 310 and oriented in the direction of inclined ramps 331 on rail 310. Rotating element 1010 is attached so as to be movable in rotation and in translation within rail 310 and guided by its axle 1011 inside grooves 1021 provided in the lateral

walls of rail 310 and extending generally parallel to inclined ramp 1020. It is formed of three coaxial rollers 1012, 1013, 1014 of different diameters and movable in rotation relative to one another: a first roller 1010 designed to move along inclined ramp 1020, a second roller 1013 designed to move along a vertical ramp 211 located at the front of counter-rail 210, and a third roller 1014 designed to move along the horizontal plane of tie rod 1050. In Figure 12A, roller device 170 is at rest, corresponding to counter-rail 210 being in the lower position in which rollers 230 are retracted inside rail 310. This lower position is stable. In Figure 12B rotating element 1010 is actuated by tie rod 1050 which exerts an upward vertical force on it using its third roller 1014, causing it to move up by moving along inclined ramp 1020 using its first roller 1012 and simultaneously on vertical ramp 211 of counter-rail 210 using its second roller 1013 and then exerting horizontal force on counter-rail 210. Counter-rail 210 effects simultaneously with horizontal translation Th, vertical translation Tv due to the displacement of rollers 240 along inclined ramps 331. Counter-rail 210 is moved to the upper position in which rollers 230 project above surface S of rail 310. This upper position is not stable because when forks 10 are disengaged from machine 20, rotating element 1010 redescends due to gravity along inclined ramp 1020, while counter-rail 210 simultaneously descends inclined ramps 331 due to

gravity to return to the lower position, with roller device 170 being returned to the resting position (cf. Figure 12A).

[056] Figures 13A and 13B are schematic representations of a ninth roller device 180 similar to the preceding one, with the actuating means 1100 also comprising an actuator in the form of a rotating element 1110 cooperating with an inclined ramp 1120 integral with roller device 180 and associated with a block formed of a tie rod 1150 added to machine 20. In this variation inclined ramp 1120 is provided at the front extremity of counter-rail 210 and oriented in the opposite direction from inclined ramps 331 on rail 310. Rotating element 1110 is attached to be movable in rotation and in translation inside rail 310 and guided by its axle 1111 in groves 1121 provided in the lateral walls of rail 310 and extending generally vertically. It is formed of three coaxial rollers 1112, 1113, 1114 of different diameters and movable in rotation relative to one another: a first roller 1112 designed to move along a vertical ramp 311 provided in the zone of the front extremity of rail 310, a second roller 1113 designed to move along inclined ramp 1120 of counter-rail 210, and a third roller 1114 designed to contact the horizontal plane of tie rod 1150. This third roller 1114 may be a non-rotating one, since its displacement is limited to vertical translation. The operation of this roller device 180 is similar to the preceding device 170.

[057] It is clearly apparent that the roller device according to the invention originates from a simple kinematic concept. For this reason it is economical to buy as well as to maintain; it occupies a small amount of space and it is durable. More specifically, counter-rail 210 can be easily removed from rail 310 to facilitate cleaning and maintenance. Because the actuator is integral with rail 310, it does not interfere with the performance of the load handling device. The advantage of this actuator is that it is automatically and mechanically activated by a block while the forks are being attached to the machine, without any energy input.

[058] The roller device as described can be sold with forks to retrofit load-handling apparatuses already in use, or integrated into new equipment. It is for this reason that the invention also applies to load-handling apparatuses (not shown) equipped with such a roller device.

[059] The present invention is not limited to the exemplary embodiments described, but extends to any modification and variation obvious to a person skilled in the art while still remaining within the scope of protection defined by the attached claims.